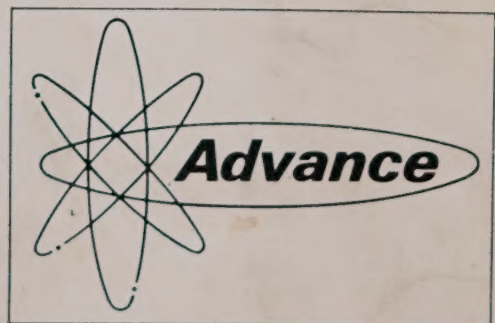


***Twin Stabilised D.C.
Supply PP6***

Instruction Manual





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Supply PP6***

Instruction Manual

ADVANCE ELECTRONICS LIMITED
INSTRUMENT DIVISION

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Introduction

Section 1

The Twin Stabilised D.C. Supply PP6 provides two independent and floating stabilised d.c. supplies, each continuously variable from 0 to 30V at 3A maximum. The two supplies can either be used separately, or connected in series to provide a maximum output of 60V at 3A.

In both sections of the instrument the output voltage range is covered in six adjacent ranges of 5V, together with a fine adjustment control calibrated in volts. A voltmeter and a four-range ammeter are provided and these can be switched independently to monitor either section.

Both sections are provided with four terminal output networks, which virtually eliminate the effect of resistance in the connecting leads to the load.

Overload protection is effected by an electronic circuit which affords complete protection against progressive and sudden short-circuit overloads. This circuit is reset from the front panel by operation of a push button.

The instrument will operate from a.c. supplies of 110V, 120V, 220V and 240V nominal. Fuses are provided to protect against both supply surges and internal component failure.



Specification

Section 2

Performance (each section) OUTPUT VOLTAGE Continuously variable 0 to 30V d.c.

OUTPUT CURRENT 0 to 3A.

OUTPUT RESISTANCE Less than 0.02 ohm.

OUTPUT IMPEDANCE Less than 0.2 ohm up to 100kc/s.

RIPPLE Less than 1 mV peak to peak. (Typically 0.25mV peak to peak.)

STABILISATION Input voltage variations of $\pm 15\%$ of nominal are permitted, the stabilisation ratio being 3000 : 1. For a change of 30% in the a.c. supply voltage, there is less than 0.01% change in the d.c. output voltage.

Metering Two meters are fitted, one an Ammeter, the other a Voltmeter. The Ammeter has four current ranges 0 to 0.1A, 0.3A, 1A and 3A F.S.D., and the voltmeter has a range of 0 to 30V. Both meters can be switched independently to either section of the instrument.

Voltage Calibration The coarse and fine voltage controls are calibrated to an accuracy of approximately 0.2V.

Overload Protection Each section is protected by an overload cut-out circuit which can be reset by

an individual push button on the front panel. The cut-out operates at 125% of F.S.D. on each current range.

Operating Temperature The instrument will operate at full load in ambient temperatures of up to $+35^{\circ}\text{C}$.

Power Supply Requirement The instrument operates from a 50c/s supply only, over the following input voltages ranges:

110V $\pm 15\%$ (94V to 126V)

120V $\pm 15\%$ (102V to 138V)

220V $\pm 15\%$ (187V to 253V)

240V $\pm 15\%$ (204V to 276V)

Power Consumption 160 Watts on full load, each section.

Dimensions Width 20in., depth 15in., height 13in. (50.8 $\times$ 38.1 $\times$ 33cm).

Weight 70lb (31.8kg).

Finish Dark blue metal case with light grey front panel and medium grey surround.

Operation

Section 3

Warning

This instrument uses transistors, and for this reason it should not be operated in ambient temperatures in excess of 35°C (95°F), or under conditions which limit free circulation of air through the ventilation panels.

3.1 Preparation for use

Remove the instrument from its case (see para. 5.1). Check the supply fuses F1 and F2 which are located in a double fuse holder at either side of the chassis (Fig. 2). For 220V and 240V supplies, F1 and F2 have a rating of 3A and for 110V and 120V supplies the fuses have a rating of 5A. Fuses of both ratings are supplied with the equipment. Fuse F3 is located in a single fuse holder adjacent to F1 and F2 and has a rating of 5A for all values of supply voltage.

Ensure that both voltage selector panels are correctly set for the local supply. Replace the instrument into its case.

Switch ammeter and voltmeter selector switches to the required section. Switch the appropriate ammeter range-switch to the 3A range, and connect the load across the OUTPUT terminals. The two sections of the instrument can be connected in series if an output of 30V to 60V is required, but under NO circumstances should the two sections be connected in parallel.

Connect the instrument to the a.c. supply (50c/s only). Set the output voltage controls to the required setting and switch on.

3.2 Metering

The ammeter and voltmeter can be switched independently to monitor either section of the instrument.

When the two sections are used in series, the output voltage is indicated by the sum of the two voltmeter readings.

3.3 Overload

The overload circuit will operate when the load current attains approximately 125% of F.S.D. on the particular current range selected by the ammeter range switch. When the cut-out has operated on one of the lower current ranges, it may be found necessary to return the current range switch to the 3A position before resetting.

On the lower current ranges it may be found that the cut-out operates again, immediately after being reset. This is due to initial charging current of C10.

The connection of an external capacitive load can also cause the cut-out to operate for the same reason.

3.4 Four terminal network

The four terminal network is provided to compensate for the output lead resistance. To make use of this facility use two further leads of any convenient gauge to connect each end of the actual load to the appropriate POTENTIAL terminals.

3.5 Fuses

The supply input circuit to each section includes two fuses (F1 and F2 in Fig. 3) in the live line and neutral. In the lower voltage range 110V, 120V the fuse rating is 5A, for the higher voltage range 220V, 240V the fuse rating is 3A. The internal circuits are protected by a 5A fuse which is F3 in the section shown.

4.1 General

The two sections of the PP6 are identical and the description that follows applies to both sections. The circuit references are those included in Fig. 3 which shows components in one section only.

The input voltage is applied to the primary winding of the Constant Voltage Transformer T1 via sections A and B of the ON/OFF switch S1, the supply fuses F1 and F2 and the supply voltage selector panel. The Constant Voltage Transformer has one high voltage and one low voltage secondary winding, the low voltage winding being tapped to provide six output voltage ranges. Capacitors C1 and C2 are a matched pair and are part of the Constant Voltage Transformer. A silicon bridge rectifier MR1 rectifies the output from the low voltage winding. The resulting d.c. is smoothed by the 12,000 μ F capacitor C4 and fed to the output terminals via the series regulator transistor TR1 and its associated series compensating potentiometer RV1. This potentiometer is ganged to the fine voltage control RV3. The ammeter can be switched into the negative line of either section by means of ammeter selector switch S4, and the voltmeter may be switched across the output terminals of either section by means of the voltmeter selector switch S6. A bleed resistor R2 is permanently connected across the smoothing capacitor C4, and this is in parallel with a 10 ohms resistor R1 when the section is switched off. R23 is a further bleed resistor connected across C10 and any other capacity in the load circuit to provide a discharge path independent of the series regulator TR1.

4.2 Stabilising circuit

The output from the high voltage secondary winding of T1 is rectified by the selenium bridge rectifier MR2, smoothed by the RC filter C5, R3, and C6, and used to provide a reference voltage via two cascaded neon stabilisers V1 (150 volts) and V2 (83 volts). A potential divider network R31 to R40 and RV3 is connected across the neon stabiliser V2 via the 1 ohm resistor R29. The voltage at the wiper of the fine voltage control potentiometer RV3 is compared with the potential across the output terminals by means of a

differential amplifier, the long-tailed pair TR4 and TR5. Sections B and C of the coarse voltage control switch S2 adjust the potential divider ratios as each output voltage step is selected. Section A selects the secondary taps on the low voltage winding of the transformer T1 and section D short-circuits the cut-out circuit momentarily during the operation of S2.

A preset potentiometer RV2 is in series with the potential divider network to permit accurate calibration of the voltage ranges. The output from the differential amplifier is amplified by two emitter follower stages TR3 and TR2, and applied as a correction signal to the base of the series regulator TR1. The effective impedance of TR1 is thus adjusted until the output and reference voltages are equal.

A four-terminal output is thus provided and when in use the POTENTIAL terminals are connected independently to the load. The stabilising circuit thus controls the actual voltage across the load, virtually eliminating the effect of the resistance of the output leads.

The correct operating potentials for the transistor circuits, including the overload cut-out, are derived from the high voltage d.c. supply via the Zener diodes MR4, MR5 and MR8.

4.3 Overload cut-out

Transistors TR6 and TR7 constitute a bistable trigger circuit with TR6 normally conducting. When the output current exceeds a predetermined value the potential developed across the cut-out shunts R44, R45, R46 and R47 actuates the trigger circuit which then changes its state. TR7 now conducts, and the potential developed across R28 is used to shut off the differential amplifier TR4 and TR5, causing the section output voltage to fall to zero.

The germanium diode MR3 isolates the trigger circuit from the differential amplifier during its normal quiescent condition. The overload cut-out is reset by means of a push button which pulses the base of transistor TR6, thereby returning the trigger circuit back to the normal condition with TR6 conducting. The cut-out level is preset by potentiometer RV4 to approximately 125% F.S.D. of the ammeter.

5.1 General

The PP6 is robustly constructed and employs transistors throughout. A high degree of reliability has been achieved and the instruments should operate indefinitely without requiring extensive maintenance.

To obtain access to the internal components, place the instrument face downwards on a flat surface, remove the five retaining screws at the back and lift off the case. Figs. 1 and 2 show the location of the components on the chassis assembly.

To remove control knobs it is first necessary to pull off the spring-loaded plastic section of each knob to expose the retaining screw. When replacing the knob, ensure that the indentation on the top of the plastic section coincides with the cursor on the skirt of the knob.

5.2 Re-alignment of voltage calibration

To re-align the voltage calibration proceed as follows:

- (1) Remove the instrument from the case and connect it to the a.c. supply. Switch ON.
- (2) Set the voltmeter selector switch to L.H. section.
- (3) Set the L.H. coarse voltage control to the 0—5V position and adjust the L.H. fine voltage control to give a voltmeter reading of 5 volts. Check that the fine voltage control cursor and the 5V mark coincide. To make any adjustment, remove the plastic knob cover and loosen the clamp screw until the knob is free to move on its spindle. Rotate the knob until the cursor and 5V mark coincide. Re-tighten the clamp screw and replace the plastic knob cover.
- (4) Set the L.H. coarse voltage control to the 20—25V position and set the fine control to 5V.
- (5) Adjust preset potentiometer RV2 (printed circuit board) to obtain a reading of 25V on the voltmeter.
- (6) Set the L.H. coarse voltage control to 0—5V position and check that for a voltmeter reading of 5 volts, the cursor of the fine voltage control is at the 5V mark.
- (7) Check that when the fine voltage control is set to the 0 mark the voltmeter indicates zero volts.
- (8) Set the coarse voltage control to the 25—30V position and check that when the fine voltage control is set to give a voltmeter reading of 30 volts, the cursor of the fine control is approximately at the 5V mark.
- (9) Repeat tests 2 to 8 on the R.H. section of the instrument. Re-adjust as necessary. The voltage calibration should now be correct.

5.3 Adjustment of overload cut-out

To adjust the overload cut-out a variable load resistor is required which can be adjusted to 12 ohms at 1A rating.

To make the cut-out adjustment, proceed as follows:

- (1) Switch the L.H. section supply switch ON.
- (2) Set the voltmeter and ammeter selector switch to L.H. section.
- (3) Set the output voltage to 12V.
- (4) Set the ammeter range-switch to 1A.
- (5) Connect the variable load resistor, set to 12 ohms, across the OUTPUT terminals, i.e. adjust this load to 12 ohms precisely by adjusting the load current to 1A as indicated by the ammeter.
- (6) Increase the output voltage by means of the fine voltage control to obtain an output of 15 volts (i.e. the ammeter will now be indicating a reading of 125% of F.S.D.).
- (7) Carefully adjust the preset potentiometer RV4, located on the printed circuit board, until the ammeter and voltmeter readings just cut-out to a zero reading.
- (8) Re-check adjustment by reducing the output voltage slightly by means of the fine voltage control. Press the cut-out reset button and re-check that the load current is 1A for a 12 volt output setting, and then further increase the output to check that the cut-out operates at precisely 15 volts.
- (9) Reduce the output voltage of L.H. Section, and reset the cut-out.
- (10) Repeat the tests 1 to 9 on the R.H. section.

Components List

Section 6

Resistors

Ref.	Description	Part No.
R1	10Ω ±10% Erie 8	140
R2	470Ω ±5% 5W. W.W. R.R.C. L.G.75	231
R3	500Ω ±10% 3W. W.W. Dubilier A1	11248
R4	Not used	
R5	12Ω ±10% Erie 9	1826
R6	Not used	
R7	Not used	
R8	33K ±10% Erie 8	1274
R9	33K ±10% Erie 8	1274
R10	33K ±10% Erie 8	1274
R11	220K ±10% Erie 9	6703
R12	22K ±10% Erie 8	6706
R13	47K ±10% Erie 8	10869
R14	47K ±10% Erie 8	10869
R15	10K ±5% 5W. W.W. R.R.C. L.G.75	381
R16	4.7K ±10% Erie 9	1499
R17	8.2K ±10% Erie 8	9146
R18	Not used	
R19	25K ±5% Erie 109 H.S.	1687
R20	1K ±10% Erie 9	1175
R21	4.7K ±10% Erie 9	1499
R22	390K ±10% Erie 9	7494
R23	1.5K ±10% Erie 8	11097
R24	1.2K ±10% Erie 9	1172
R25	2.2K ±10% Erie 9	867
R26	10K ±10% Erie 9	671
R27	12K ±5% Erie 9	6964
R28	2.2K ±10% Erie 9	867
R29	1Ω ±10% 3W. W.W. R.R.C. Type RWV 4-J	239
R30	1Ω ±10% 3W. W.W. R.R.C. Type RWV 4-J	239
R31	2.5K ±1% H.S. Erie 109 H.S.	1686
R32	2.5K ±1% H.S. Erie 109 H.S.	1686
R33	2.5K ±1% H.S. Erie 109 H.S.	1686
R34	2.5K ±1% H.S. Erie 109 H.S.	1686
R35	2.5K ±1% H.S. Erie 109 H.S.	1686
R36	2.5K ±1% H.S. Erie 109 H.S.	1686
R37	2.5K ±1% H.S. Erie 109 H.S.	1686
R38	2.5K ±1% H.S. Erie 109 H.S.	1686
R39	2.5K ±1% H.S. Erie 109 H.S.	1686
R40	2.5K ±1% H.S. Erie 109 H.S.	1686
R41	120K ±10% Dub. BTS	1732
R42	10K ±5% 5W. R.R.C. L.G.75	381
R43	47K ±10% Erie 8	10869
R44	0-1Ω 5" s.w.g. eureka wire	2024
R45	0-2Ω 9 $\frac{1}{2}$ " 26 s.w.g. eureka wire	1513
R46	0-7Ω 6 $\frac{1}{2}$ " 22 s.w.g. eureka wire	1370
R47	2-0Ω 10 $\frac{1}{2}$ " 18 s.w.g. eureka wire	1957
RV1	1-66Ω Lin Pot. Berco Type L25	1691
RV2	5K Lin. Preset Pot. Colvern Type PC1/1/P	1692
RV3	2-7K Lin. ±2% Pot. Colvern Type CLR40/152/1671	1694
RV4	3-9K Lin. Preset Pot. Colvern Type PC1/1/P	1693

Capacitors

C1	5μF + 10%—5% 360V. WKG. Dubilier Type DU41 Selected	8882
C2	5μF + 10%—5% 360V. WKG. Dubilier Type DU41 Selected	8882

Ref.	Description	Part No.
C3	330 pF Silvered Mica Lemco 1106S	2307
C4	12,000μF 50V. Elect. Plessey CE.1520/9	13121
C5	32μF + 32μF. 350V. D.C. Elect. Hunts	
C6	KBQ.417.T. L32/3	135
C7	25μF. 50V. D.C. Elect. Hunts Mew 39. L28/1	10027
C8	0-047μF. 125V. D.C. Phillips Polyester C296/AA/A	792
C9	25μF. 50V. D.C. Elect. Plessey C.E. 203	475
C10	500μF. 100V. D.C. Elect. Hunts K.B.169.A.G	427
C11	0-5μF ±20% 500V. D.C. Plesseal	610
C12	200μF. 6V. D.C. Elect. Plessey C.E.206	12972
C13	0-005μF. —20 +80%. Erie K3500/CD8	1514

Transistors

TR1	OC28 Mullard	148
TR2	OC28 Mullard	148
TR3	OC44 Mullard	338
TR4	OC44 Mullard	338
TR5	OC44 Mullard	338
TR6	OC44 Mullard	338
TR7	OC44 Mullard	338

Rectifiers

MR1	Rect. Bridge Silicon S.T.C. Type RS.52 AF.3 1B1/C61	1714
MR2	Rect. Bridge Seleniums S and H B250-C75	12784
MR3	Diode, Germanium. Mullard OA91	2490
MR4	Diode, Zener. Brush Crystal Type Z5.6	128
MR5	Diode, Zener. Mullard OAZ.208	1723
MR6	Rect. Bridge Selenium. S and H B30-C600	334
MR7	Diode, I.R.C. 2E4	500
MR8	Diode, Zener. Brush Crystal Type Z5.6	128

Miscellaneous

V1	Neon, Mullard 150 C4	154
V2	Neon, Ericsson GD.83.M	1460
S1	Switch, Toggle On/Off T.P.D.T. Arrow 93A/416.B13	1689
S2	Switch, Wafer Type. Coarse Voltage Control	14968
S3	Switch, Wafer Type. Ammeter Range Assy. with Cut-out Shunts R44, R45, R46 and R47	15320
S4	Switch, Wafer Type. Ammeter Selector	13389
S5	Switch, Press-button. Arco Electric Type T.936	1690
S6	Switch, Wafer Type. Voltmeter Selector	13389
LP1	Lamp, Indicator	12931
F1	Fuse 3A. Belling Lee	428
F1	Fuse (Alternative) 5A. Belling Lee	12807
F2	Fuse 3A. Belling Lee	428
F2	Fuse (Alternative) 5A. Belling Lee	12807
F3	Fuse 5A. Belling Lee	12807
T1	Transformer, Advance Comp. Volstat	MD 395
V	Voltmeter, Ernest Turner	13395
A	Ammeter (See "M.S.") Ernest Turner	14813
M.S.	Meter Shunt Unit (Supplied with Ammeter) Instruction Manual	1712

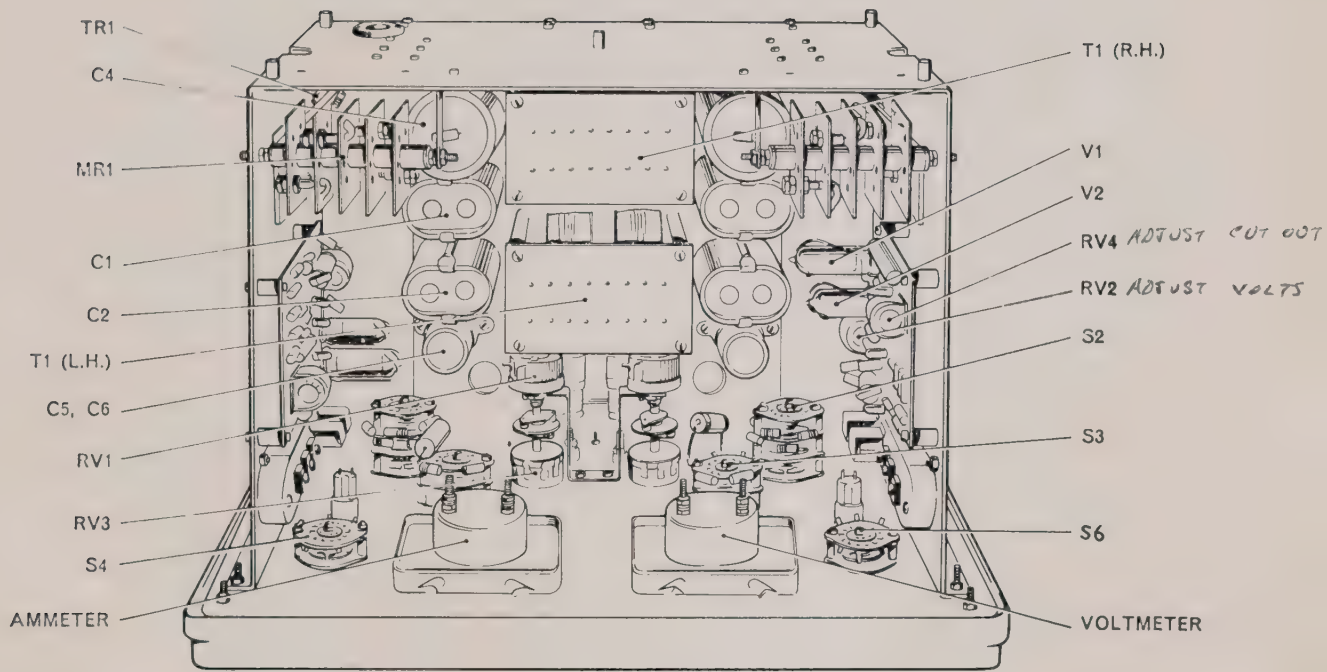


FIG. 1 COMPONENT LOCATION — TOP VIEW

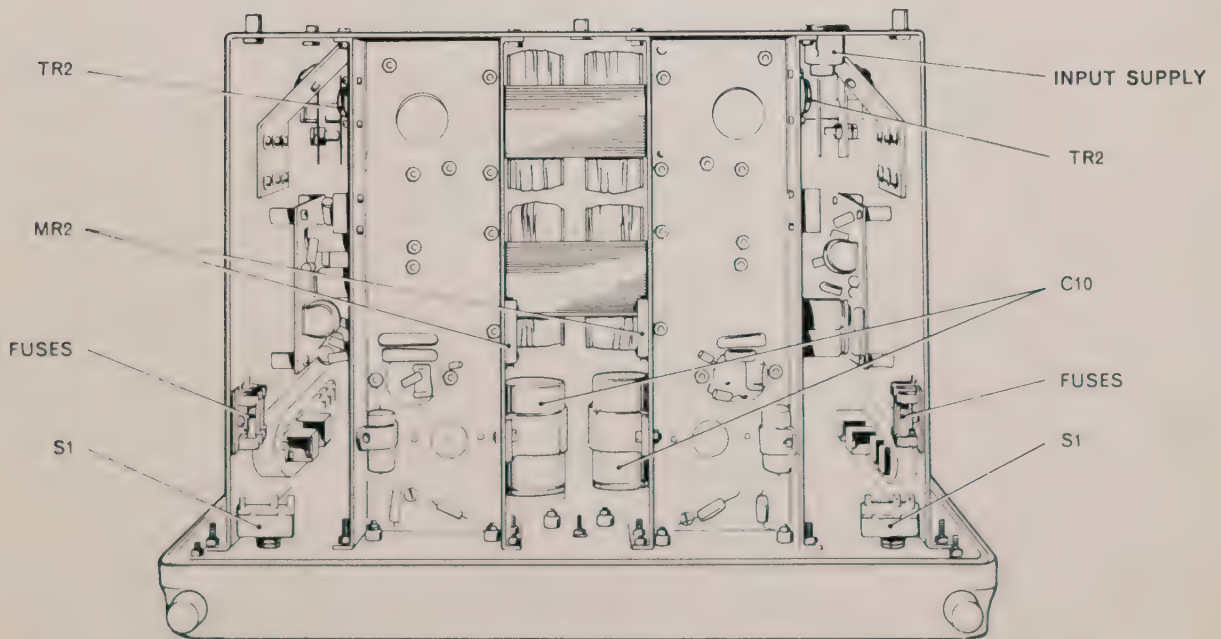
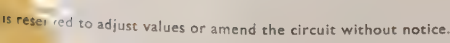
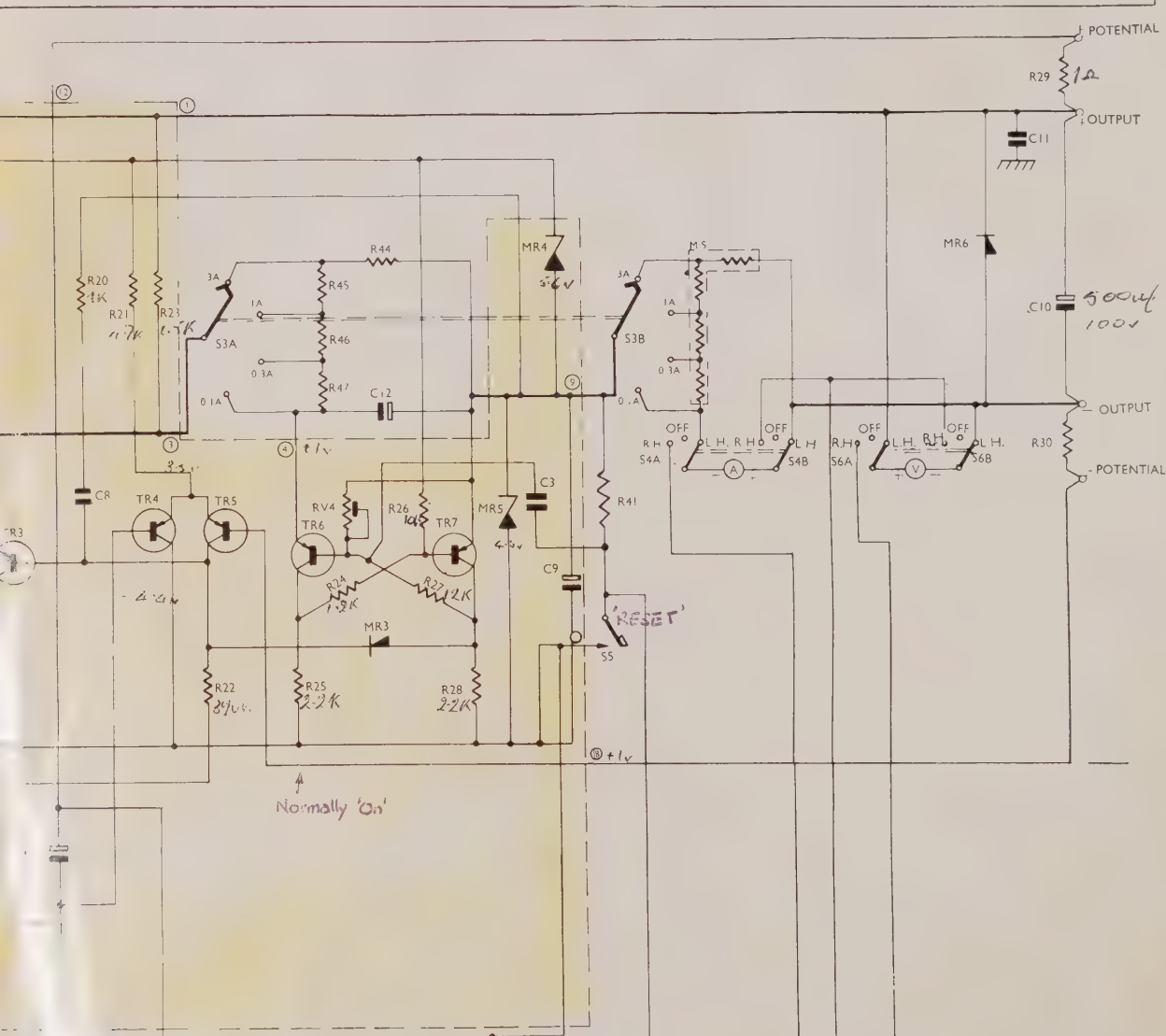


FIG. 2 COMPONENT LOCATION — UNDERSIDE VIEW



Guarantee and Service Facilities

Section 7

This instrument is guaranteed for a period of one year from its delivery to the purchaser, covering the replacement of defective parts other than valves, semiconductors and fuses. Valves and semiconductors are subject to the manufacturers' guarantee.

We maintain comprehensive after sales facilities and the instrument can, if necessary, be returned to our factory for servicing. The Type and Serial Number of the instrument should always be quoted, together with full details of any fault and the service required. The Service Department can also provide maintenance and repair information by telephone or letter.

Equipment returned to us for servicing must be adequately packed, preferably in the special box supplied, and shipped with transportation charges prepaid. We can accept no responsibility for instruments arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument, or if the guarantee has expired, the repair will be put in hand without delay and charged unless other instructions are received.

OUR SALES, SERVICE AND ENGINEERING DEPARTMENTS
ARE READY TO ASSIST YOU AT ALL TIMES.

ADVANCE ELECTRONICS LIMITED